Effects of the Proposed Action

The section below discusses direct and indirect effects on listed, proposed, and candidate species or their critical habitat that result from the proposed action. Cumulative effects (effects of future State, local, or private actions on endangered and threatened species or critical habitat) are discussed separately at the end of this section. Effects are analyzed on an ecosystem level, including all species that could be impacted by the actions. Anadromous salmonids are under the legislative authority of the NMFS but are discussed here because of the interrelated nature of the effects; however, separate consultation with NMFS is required to fully address effects on these species.

Assumptions

The assumptions used in this effects analysis are as follows:

1. The conservation actions described in the Project description will be fully implemented, including **Agency Commitments for New and Continuing Project Actions** (page 2-3), specific guidance for **Water Service Contracts** (page 2-10), and **Conservation Measures** (page 2-31).

2. Reclamation and the Service will request adequate funding for the CVP Conservation Program as necessary to implement this biological opinion.

3. Discharges into surface water bodies by CVP water contractors comply with the standards set in the biological opinion on the California Toxics Rule.

4. All components of the San Joaquin Valley Drainage Program's Final Report that pertain to the CVP's contract service area are implemented in a manner that does not preclude recovery of listed and proposed species–specifically, Selenium discharges into the San Joaquin River do not preclude recovery of listed and proposed species that are using impacted waterways, e.g. the San Joaquin River and its tributaries and the Sacramento San Joaquin Delta. Interior will conduct monitoring to determine whether existing discharges are impacting recovery of Sacramento splittail, delta smelt, and giant garter snake. Monitoring and evaluation of results will be used to determine effects prior to long-term contract renewal.

5. Long-term contracts will be renewed, and Reclamation will complete tiered site-specific consultations with the Service. No CVP water will be delivered or applied outside current contract service areas until either formal or informal consultation is complete. In some cases, deliveries in excess of the average historical delivery amounts to water districts may result in a change in land-use practices in the districts and indicate the need for informal consultation between Reclamation and the Service.

Once formal site-specific consultation has occurred that is in compliance with this opinion, it is assumed that changes in land-use practices, and impacts to listed and proposed species, in the districts have been addressed.

6. Interior will work with Sacramento River Water Rights Settlements contractors and San Joaquin River Exchange contractors to develop conservation measures for listed species, as appropriate, and will communicated and coordinate with the Sacramento River Water Rights Settlement contractors and San Joaquin River Exchange contractors in determining how to address any effects to listed species, as necessary, through section 7 or section 10.

7. For Warren Act, water wheeling, 215 water contracts, and water transfers, Reclamation and the Service will establish a tracking program that assures compliance with the ESA.

8. Conservation strategies will be in place for the districts or areas receiving CVP water. The types of strategies that could be accepted are: Habitat Conservation Planning as described in section 10(a) of the ESA; programmatic land management actions that include protection of listed and proposed species; requirements resulting from site-specific section 7 consultation; or an expansion of the existing CVP Conservation Program that adequately compensates for the direct and indirect effects of increased water delivery to an area.

9. Reclamation will informally consult with the Service, and the Service will conduct intra-Service consultation, to determine whether any future CVP actions (including water transfers and permanent assignment of CVP waters) will affect listed species prior to signing a FONSI or ROD.

10. Interior will work closely with the water users, providing them maps of listed species habitats within their service-areas and guiding them through the consultation process to address site-specific effects. Reclamation may encourage CVP contractors to complete HCPs encompassing the affected areas.

11. Reclamation will consult on all changes in purpose of use for CVP water contracts, including changes from Agriculture to Agriculture/Municipal and Industrial purposes.

12. Reclamation and CVP contractors will comply with all opinions related to the CVP (listed on pages 1-4 to 1-5). Flow standards that form the environmental baseline of the 1995 OCAP biological opinion will be met, and Reclamation will take no discretionary actions (e.g. new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed. (Appendix K, letter to the Service and NMFS from Reclamation, dated October 29, 1999.)

13. Any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect, and the Service and Reclamation are adequately funded and staffed to complete tiered site-specific consultations from this opinion and track implementation of conservation actions.

14. Implementation of, and conformance with, recovery plans will be an integral part of all site-specific consultations.

15. The baselines of the species in Appendix B are stable or increasing, and monitoring (for the life of the project) will be implemented immediately to test and track this assumption.

16. The CVP will be managed in a manner consistent with the CVPIA Section 3406(b)(2) decision of October 1999.

17. Reclamation and CVP contractors will comply with all opinions related to the CVP (listed on pages 1-4 and 1-5).

18. Reclamation will coordinate closely with the Service during development and implementation of all O&M Plans and Resource Management Plans.

19. This biological opinion is based on information in the Service's file # 1-1-98-0124. New information may become available that indicates one or more of the above assumptions have not been met. If this occurs, Reclamation and the Service will reinitiate this consultation.

Direct and Indirect Effects

Direct effects include those actions that are the direct result of the proposed action. Direct effects include interrelated actions (actions that are part of the larger proposed action and depend on the larger action for their justification) and interdependent actions (actions having no independent utility apart from the proposed action). Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The proposed action includes the continuing operation and maintenance of the CVP and implementation of the CVPIA and other resource conservation measures. It is assumed in this analysis that water will continue to be supplied up to the average delivery amounts (from years 1988 through 1997). Specific information on individual species can be found in the species accounts in Appendix E. Specific information on habitat types and trends can be found in the Baseline section of this opinion.

Site-Specific Effects from Operations and Maintenance

Blunt-nosed Leopard Lizard - An estimated 150 miles of CVP canals are within the range of the blunt-nosed leopard lizard. When blunt-nosed leopard lizards are above ground, during the summer active period, it is expected that they are likely to avoid direct mortality from maintenance activities such as mowing, but those activities may affect blunt-nosed leopard lizard foraging and reproduction.

Giant Garter Snake - An estimated 450 miles of CVP canals are within the range of the giant garter

snake. Many species of garter snake retreat into rodent burrows when disturbed and then leave the burrow when the disturbance increases. This behavior makes garter snakes very susceptible to being killed during mowing; however, it is expected that giant garter snakes are more likely to retreat into canals during disturbance-causing activities. Dredging can bury giant garter snake habitat, and potentially the snakes, when dredge spoils are placed on canal tops or banks. Dredging of CVP canals is an infrequent activity, therefore it is expected that no more than one linear mile of aquatic garter snake habitat will be buried annually.

Giant Kangaroo Rat and Tipton Kangaroo Rat - The giant kangaroo rat and Tipton kangaroo rat may inhabit as much as100 miles of CVP canals each. Kangaroo rats are very sensitive to sound and maintenance activities during the breeding season is likely to disrupt reproduction and affect foraging.

San Joaquin Kit Fox - An estimated 250 miles of CVP canals are within the range of the 250 miles of CVP canals and suitable denning and foraging habitat is likely to occur withing 200 feet on the upland side of the waterline. Mowing and other maintenance activities are likely to cause harassment of kit foxes. Because of careful implementation of avoidance measures, it is not expected that there will be any harm or harassment of San Joaquin kit foxes associated with natal dens.

Valley Elderberry Longhorn Beetle - Based on existing management projections, it is expected that as many of 200 elderberry plants, each with at least one stem measuring 1.0 inch or greater in diameter at ground level, or 2,000 elderberry stems measuring 1.0 inch or greater in diameter at ground level may be disturbed annually due to routine maintenance annually.

Vernal Pool Crustaceans - The standard avoidance measures for vernal pool crustaceans make the likelihood of impacting larger, more noticeable, pools unlikely. However, small pools make be inadvertently impacted by heavy equipment in some instances. It is estimated that no more than 0.5 acre of vernal pools in any one county during a twelve-month period are likely to be impacted.

Scope and Distribution of Effects

The direct and indirect effects of the CVP can occur throughout the Central Valley, Santa Clara Valley and part of San Benito County, Sierra and coastal foothills, and Delta by actions such as water impoundments and diversions, agricultural conversion and related operations, urban development, and continued operations and maintenance of the CVP. Listed species and critical habitat occur throughout the study area on (1) native habitats, (2) agricultural lands, and (3) marginal habitats surrounding reservoirs, conveyance facilities, pumping plants, urban centers, and agricultural lands. Activities associated with the CVP can thus directly or indirectly affect listed species or their critical habitat. For example, upstream water diversions affect the aquatic and riparian species downstream of the diversion. In addition, upland habitats supporting listed species are being converted to agricultural or urban land uses facilitated by availability and use of CVP water supplies.

Timing of Effects

CVP water is diverted year-round, although the majority is delivered during the spring and summer growing seasons. Water impoundments prevent heavy winter and spring run-offs, and diversions reduce water available during other parts of the year. Many species of fish require adequate flows during sensitive periods of their life cycle. Flood flows and spring runoff enhance the ecosystem when they: (1) scour out blocked channels to allow upward migration, (2) supply cool, fresh water needed for spawning, (3) inundate essential spawning habitat to allow for spawning, and (4) assist out-migration of juveniles.

Activities associated with agricultural operations often occur during sensitive periods of terrestrial species' life cycles. Ground disturbance and pesticide application often occur during reproductive effort and juvenile growth. Breeding, feeding, and foraging of listed species can be disrupted by agricultural operations during mating, denning, nesting, whelping, or other reproductive behavior.

Loss of adequate flows to sustain listed and proposed aquatic species can reasonably be expected to reduce the likelihood of survival and recovery of those species. However, this should not be the case given the assumptions that (1) the CVP will be managed in a manner consistent with the CVPIA Section 3406(b)(2) decision of October 1999; (2) flow standards that form the environmental baseline of the 1995 OCAP biological opinion are met; (3) Reclamation does not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed
–Appendix K, letter to the Service and NMFS from Reclamation, dated October 29, 1999; and (4) Reclamation and CVP contractors are in compliance with all opinions related to the CVP (listed on pages 1-4 and 1-5).

Agricultural operations during the breeding seasons of terrestrial species can reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that (1) any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect, (2) implementation of recovery plans will be an integral part of site-specific consultation, (3) ongoing monitoring and mapping of listed and proposed species baselines is occurring, and (4) baselines for listed species are shown to be increasing, or at least stable, by the monitoring.

Nature of the Effects

The pumping, delivery, and application of CVP water can adversely affect various aspects of the biology of listed species, including reproduction, growth, survival, migration, predator avoidance, and foraging. Conversion of habitats has eliminated or greatly reduced habitat use by listed species. Activities such as water impoundments and diversions, agricultural land conversions and related operations, municipal and industrial development, and operations and maintenance will continue to

directly and indirectly affect listed species and their habitat. A detailed description of the nature of the effects of the pumping, delivery, and application of CVP water follows. See Table 4.A. (following page) for habitats adversely affected by CVP activities. A more complete explanation of habitat trends can be found in the Baseline section of this opinion.

Table 4.A. Activities associated or facilitated by the CVP and the habitats that may be directly or indirectly adversely affected. Actual effects would be determined on a site-specific basis. An "X" denotes those activities that have the greatest impact on the habitat type, although the other activities may have an impact as well.

Habitat Type	Water Impoundments & Diversions	Agricultural Conversion & Related Operations	Municipal & Industrial Development	Operations & Maintenance
Delta Aquatic Habitats	X	X	X	X
Vernal Pool Habitats		X	X	X
Freshwater Wetland Habitats	X	X	X	X
Riparian Habitats	X	X	X	X
Coastal Beach/Lagoon/Dune Habitats	X	X	X	
Salt Marsh Habitats	X		X	
Interior Grassland Habitats		X	X	X
Alkali Scrub Habitats		X	X	X
Oak Woodland Habitats		X	X	
Evergreen Hardwood and Coniferous Habitats			X	
Chaparral Habitats			X	
Coastal Scrub and Coastal Grassland			X	

Water Impoundments and Diversions

Water impoundments and diversions include: construction of dams, levees, pumping plants, and conveyance facilities; diversion of water out of the natural water course; and conveyance of the water to a different location. These activities have caused the loss and degradation of listed species habitat such as Delta aquatic habitat, wetlands, riparian corridors, coastal beaches and lagoons, and salt marshes. Diversions reduce the water available to water-dependent listed species such as Delta fishes,

anadromous salmonids, and riparian-dependent species.

The direct and indirect effects of water impoundments and diversions include the following:

1. Effects of impoundment, pumping and conveyance on fish include: direct mortality from pumping activities; mortality when listed fish and their predators are drawn into small areas (such as the Clifton Court Forebay), leaving them vulnerable to predation; entrainment of fish into water diversion facilities where they are killed by the pumps; reverse flows of waters in the Delta and San Joaquin River which confuse fish and disrupt migration; diversion of fish into canals from which they cannot return to suitable breeding and foraging habitat; prevention of upstream migration by dams; dewatering of portions of the San Joaquin River upstream of its confluence with the Merced that has eliminated native salmonids from the upper San Joaquin watershed; alteration of the magnitude, timing, and duration of flows; prevention of heavy spring run-off; constriction of low salinity habitat to deep-water river channels of the interior Delta; destruction of spawning, rearing, and refugial habitat; scouring of spawning areas by high flow releases from dams; changes in the hydrologic patterns in Delta waterways; movement of the mixing zone (X2) upstream from Suisun Bay to the interior of the Delta, where foraging and breeding habitat is poor in quality and limited in area; delays in correcting Delta flow problems, caused by time lags of one to three days between water releases from CVP reservoirs and arrival of water in the Delta; water temperature fluctuations; and loss and degradation of shallow water habitat and salt marsh habitats.

2. Flow regulation affects vegetation structure by preventing regeneration of riparian corridors, changing salt marsh vegetation by altering salinity, and degrading coastal lagoons. The vegetation in marshes around Suisun Bay has been increasingly converted from brackish to saltmarsh species due to the diversion of freshwater from the Delta and further exacerbated by droughts.

3. Construction of dams, pumping and conveyance facilities, and levees, as well as preparation of these sites for construction, have footprint effects that cause: direct loss of riparian bottomlands, grasslands, vernal pools, and other upland habitat; flooding of riparian valleys and the degradation of downstream riparian corridors; changes in hydrology and aquifers; and altered dispersal patterns of terrestrial species due to impassible barriers.

Construction of new facilities, raising dam levels, and modifications of operating parameters of existing facilities would increase the amount of water available, thereby facilitating the continued conversion of native habitat as described below. Site specific information is needed for a full determination of impacts of new facilities or modifications of existing facilities, so these actions are not covered in this opinion.

Decline of habitats and species numbers is expected to continue if water diversions and impoundments increase. Degradation of listed species habitats and lack of recovery of certain listed species is expected to continue as long as significant amounts of water continue to be impounded and diverted.

Water impoundments and diversions have ultimately led to the listing of many species and can reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the CVP will be managed in a manner consistent with the CVPIA Section 3406(b)(2) decision of October 1999; flow standards that form the environmental baseline of the 1995 OCAP biological opinion are met; Reclamation does not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed–Appendix K, letter to the Service and NMFS from Reclamation, dated October 29, 1999; Reclamation and CVP contractors are in compliance with all opinions related to the CVP (listed on pages 1-4 and 1-5); conservation actions described in the Project Description of this opinion are fully implemented, including Agency Commitments for New and Continuing Project Actions (page 2-3), specific guidance for Water Service Contracts (page 2-10) and Conservation Measures (2-31); discharges into surface water bodies by CVP water contractors resulting from CVP water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (number 1-1-98-F-21); Reclamation will consult on all changes in purpose of use for CVP water contracts from Agriculture to Agriculture/Municipal and Industrial; monitoring is implemented which shows that the baselines of the species in Appendix B are stable or increasing; and the Bureau and the Service will coordinate when the quantity of water to be delivered to the districts exceeds the average historical delivery amounts and in the view of the Service may affect listed or proposed species.

Agricultural Conversions and Related Operations:

Agricultural conversions and related operations either directly or indirectly facilitated by the CVP include: conversion of native habitats to agricultural fields; conversion of land use to more water intensive purposes; disposal of agricultural drainwater; application of pesticides; and other mowing and harvesting operations. Agricultural conversion and related operations have contributed to the loss and degradation of listed species habitat such as Delta aquatic habitat, vernal pools, wetlands, riparian habitats, coastal habitats, grasslands, alkali scrub, oak woodlands, rare serpentine soil habitats, and Antioch dunes habitat. Most of the other types of habitats considered in this opinion have also been affected to some degree by agricultural operations.

The direct and indirect effects of agricultural conversions and related operations facilitated by the CVP include the following:

1 Direct loss of upland, riparian and wetland habitats occurs when native habitats are converted to irrigated agriculture either with associated CVP allocations or in anticipation of a CVP allocations (e.g., via water transfers, water freed-up by water

conservation actions or land retirement). Conversion of native habitats such as vernal pools and uplands occurs by means of plowing and deep-ripping and reduces or eliminates the habitat's suitability for listed species.

2. Potential direct loss of upland, riparian and wetland habitats can occur with use new CVP supplies from raising dams of existing project facilities or from building new project facilities.

3. Conversion of native habitats to irrigated agriculture indirectly facilitated with CVP water allocations via the following means:

   a. Use of groundwater augmented by CVP water via 1) recharge from the application of CVP water to agricultural land; 2) recharge from adjacent project facilities; or 3) recharge from CVP water applied to water banks.

   b. Use of tail water produced from application of CVP water to agricultural land.

   c. Use of recycled water on agricultural land produced from application of CVP water to municipal and industrial development.

4. Degradation and fragmentation of remaining habitat, potentially without regard for the need of dispersal corridors, greatly reducing its value for listed species.

5. Effects to aquatic habitats from agricultural run-off include siltation of stream habitat and reduced water quality.

6. Effects from agricultural drainwater contamination, an unwanted byproduct of irrigating poorly drained soils on the westside of the San Joaquin Valley include: reduced water quality (*e.g.*, high concentration of total dissolved solids); degradation of surface- and groundwater quality through salinization and contamination by elevated concentrations of toxic or potentially toxic trace elements (*e.g.*, arsenic, boron, chromium, molybdenum, and/or selenium); direct loss of habitat from construction of on-farm disposal options such as evaporation ponds and agroforestry plantations; and adverse biological effects in native species associated with drainage-contaminated habitats. The effects of selenium poisoning on avian species include: gross embryo deformities, winter stress syndrome, depressed resistance to disease due to depressed immune system function, reduced juvenile growth and survival rates, mass wasting, loss of feathers (alopecia), embryo death, altered hepatic enzyme function, and mortality. The potential effects of selenium on mammal species include: gross embryo deformities, reduced longevity, winter stress syndrome, depressed resistance to disease due to depressed immune system function, reduced juvenile growth and survival rates, food aversion and mass wasting, loss of hair and nails, reduced reproductive success, skin lesions,

respiratory failure, lameness, paralysis, and mortality. Little information is available for the effects of selenium on reptiles and amphibians. Due to the close phylogenetic relationship between birds and reptiles, reptiles are likely to be similarly effected by selenium as birds are. Effects of selenium on fish include: gross embryo deformities. growth inhibition, depressed immune response, mass wasting, changes in blood parameters and tissue structure, edema, reduced activity and feeding, reduced survival, and mortality. The synergistic effects of selenium and mercury include embryo deformities, embryo death, reduced juvenile survival, behavioral abnormalities, depressed immune response, mass wasting, and mortality.

7. Insecticides, herbicides, and rodenticides applied to agricultural lands can adversely affect listed species by: direct mortality; secondary poisoning of predators and scavengers; degradation of habitat quality following herbicide application; loss of prey base after pesticide application; reduced water quality; impacting native habitat through pesticide and herbicide drift; and loss of pollinators.

8. Effects to terrestrial species include: loss of upland refugia near aquatic habitats; altered migration and dispersal patterns of animals due to large tracks of agricultural land; reduced likelihood of seed dispersal across agricultural fields; reduced survival in degraded habitats within and around agricultural operations; and reduced survival due to necessary operations such as mowing and harvesting.

Land conversion from native habitat to farmland is facilitated in part (directly or indirectly) by the supply of CVP water, and continues to occur. The California Department of Forestry and Fire Protection (1988) predicted net loss of 775,000 acres of native habitat in the Central Valley from 1980-2010. Between 1990 and 1996, a gross total of approximately 72,700 acres of native habitat were converted to farmland in 30 counties (total area 23.1 million acres) in the Conservation Program Focus area (California Department of Conservation 1994, 1996, 1998). This figure includes 1,206 acres of urban land, 42,520 acres of grazing land, 93 acres of water, and 28,854 acres of other land (predominantly native habitat). Net trends in agricultural acreage were negative over this period due largely to land idling in the southern San Joaquin Valley. To identify trends over a longer period, we analyzed DWR land use data collected from 1972 to 1998 for 21 counties in the Central Valley and Central Coast. Analysis of these data, although complicated by non-synchronous surveys and inconsistencies in survey area, indicates that net conversion of native habitat to agricultural and urban uses has averaged about 24,000 acres annually. Gross losses of native habitat have been considerably larger, because the net loss includes substantial increases in the "native" category from long-term idling or retirement of farmland. These recently created native lands may not constitute high-quality habitat for listed species. Expansion of agriculture into marginal or upslope lands continues to affect native habitat. The Service has identified at least 9,820 acres of endangered species habitat on 16 sites in Fresno, Kern, Madera, Merced, and Tulare Counties that have been lost to unpermitted conversions between 1997 and 1999. Changes to more intensive farming practices (from dryland farming to irrigated agriculture or from discing to deep-ripping) also increase the severity of agricultural impacts on endangered species.

Continued conversion of native habitats is one of the greatest threats to the survival of listed species in the Central Valley. The number of listed species in California continues to rise, in large part due to the loss and degradation of habitat from agricultural conversion. Conversions will continue to occur as irrigated/cultivated agriculture in the Central Valley continues to expand.

The effects of CVP water deliveries on groundwater recharge can be estimated as follows. The CVP delivered 3.4 million-acre-feet of irrigation water to farms in 1978 (Reclamation 1981). Thus, the CVP supplies about 31 percent of the surface water diversion irrigation water of 11 million-acre-feet. Using the same proportion of 31 percent to calculate the share of CVP to the aquifer recharge by surface diversion irrigation water of 4.6 million-acre-feet indicates that about 12 percent (1.4 million-acre-feet) of the groundwater recharge in the Central Valley is supplied by CVP each year, and the overall recharge over several years amounts to 2.3 million-acre-feet or about 20 percent of the 11.5 million-acre-feet of groundwater pumping for irrigation. Taken together, CVP supplies about 5.7 million-acre-feet or 25 percent of the 22.5 million-acre-feet of agricultural irrigation water used each year. Groundwater pumping is used in many areas of the Central Valley to substitute for or supplement surface diversion irrigation water during dry years (Williamson *et al*. 1989). As a result, the CVP contributes significantly to effects on most of the irrigated farmlands and urban uses of water in the Central Valley. Thus the entire service areas of the water districts and their associated groundwater basins, not merely those parcels that purchase water directly from Reclamation, should be included for all considerations regarding the adverse effects associated with land use changes.

Decline of habitats and additional listing of species is expected to continue if conversion of native habitat for agricultural purposes continues. Degradation of listed species habitats and lack of recovery of certain listed species is expected to continue as a result of continued agricultural operations and indirect effects of those operations.

Agricultural conversions, which are an indirect effect of water impoundments and diversions, have ultimately led to the listing of many species and can reasonably be expected to reduce the likelihood of survival and recovery of these species. However, this should not be the case given the assumptions that: any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect; implementation of recovery plans will be an integral part of site-specific consultation; Interior will work closely with the water users, providing them maps of listed species habitats within their service areas and guiding them through the consultation process to address site-specific effects; conservation strategies will be in place for districts or areas receiving CVP water; the CVP will be managed in a manner consistent with the CVPIA Section 3406(b)(2) decision of October 1999; flow standards that form the environmental baseline of the 1995 OCAP biological opinion are met; Reclamation will not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed–Appendix K, letter to the Service and NMFS from Reclamation, dated October 29, 1999; Reclamation and CVP contractors comply with all opinions related to the CVP (listed on pages 1-4 and 1-5); Interior will ensure full implementation of the conservation actions described in the Project

Description of this opinion, including Agency Commitments for New and Continuing Project Actions (page 2-3), specific guidance for Water Service Contracts (page 2-10) and Conservation Measures (2-31); discharges into surface water bodies by CVP resulting from CVP water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (number 1-1-98-F-21); Reclamation will consult on all changes in purpose of use for CVP water contracts from Agriculture to Agriculture/Municipal and Industrial; monitoring is implemented which shows that the baselines of the species in Appendix B are stable or increasing;and the Bureau and the Service will coordinate when the quantity of water to be delivered to the districts exceeds the average historical delivery amounts and in the view of the Service may affect listed or proposed species.

Municipal and Industrial Development

Municipal and industrial development facilitated by the CVP includes the following: conversion of native habitat to municipal and industrial uses; conversion of agricultural land for municipal and industrial uses; construction of infrastructure and supportive networks; pesticide and herbicide application; and recreational uses. Municipal and industrial development has contributed to the loss and degradation of all of the habitats described in the Baseline section of this opinion.

The direct and indirect effects of municipal and industrial conversions facilitated by the CVP include the following:

1. Direct loss of upland, riparian and wetland habitats when native habitats are converted to municipal and industrial land use either with associated CVP allocations or in anticipation of a CVP allocations (e.g., via water transfers, water freed-up by water conservation actions or land retirement). Conversion of native habitats to municipal and industrial development eliminates the habitat's usefulness for listed species.

2. Potential direct loss of upland, riparian and wetland habitats can occur with use new CVP supplies from raising dams of existing project facilities or from building new project facilities.

3. Conversion of native habitats to municipal and industrial development indirectly facilitated with CVP water allocations via the following means:

    a. Use of groundwater augmented by CVP water via (1) recharge from the application of CVP water to agricultural land; (2) recharge from adjacent project facilities; or (3) recharge from CVP water applied to water banks.

    b. Use of recycled water produced from application of CVP water to municipal and industrial development.

4. Degradation and fragmentation of remaining habitat, potentially without regard for the need of dispersal corridors, greatly reducing its value for listed species, including extreme degradation of rare habitats found only in a certain region (*e.g.*, serpentine and gabbro soils).

5. Recreational disturbance effects including: off-road vehicle use which disturbs and degrades habitats such as dunes; recreational use of beaches that degrades habitat; trampling by hikers, dogs, and horses; disturbance of normal behavioral patterns; and other human recreational disturbances that degrade upland habitat and disrupt the natural cycles of native species.

6. Development of infrastructure and supportive activities including: road construction and maintenance which eliminates, fragments, and disturbs habitat; energy development that eliminates upland habitat; freshwater discharges from waste water facilities that alter salt marsh habitats; fire suppression for protection of human habitations, resulting in degradation of fire-dependent habitats such as chaparral; clearing of uplands for fire breaks; power line installation and maintenance; and waste disposal sites that eliminate habitat such as serpentine soils.

7. Effects from urban development including: increased erosion; increased roadkill incidence; increased pesticide use; increased predation by pets and introduced animals such as red foxes; and reduced water and air quality.

It has been estimated that between 12,000 and 50,000 acres of land are converted from agricultural use to urban use per year in the Central Valley of California, a number that is expected to increase in the future (Sokolow, 1997). Conversion of agricultural land to urban use between 1995 and 2040 has been predicted to exceed 1,000,000 acres (Thompson et al. 1995). Between1990 and 1996, a total of approximately 101,700 acres were converted to urban land use in 30 counties in the Conservation Program Focus area (California Department of Conservation 1994, 1996, 1998). This figure includes 49,705 acres of farmland, 20,476 acres of grazing land, 113 acres of water, and 31,366 acres of other land (predominantly native habitat). The CVPIA PEIS projects that municipal and industrial land use in the Central Valley will increase 50 percent in the next 30 years (USBR 1997). Urban lands are unsuitable habitat for many species that are able to persist in agricultural landscapes, and are virtually impossible to restore as wildlife habitat than are agricultural lands. Because one acre of irrigated agricultural land requires more water than that same acre in urban use, conversion of agricultural land to municipal and industrial use frees up some water that can be used to convert additional native habitat. Reducing water deliveries during drought is also more difficult on urban lands than on agricultural lands, so agricultural to urban conversions reduce the flexibility of the CVP to respond to water shortages.

Several rare habitat communities (such as those on gabbro soils and serpentine soils) are currently under increasing pressure to be developed for municipal and industrial uses. Decline of habitats and species numbers is expected to continue as urban expansion persists and the population of California

continues to rise. Degradation of listed species habitats and lack of recovery of certain listed species is expected to continue as a result of indirect impacts from urban centers.

Municipal and industrial development, which is an indirect effect of water impoundments and diversions, can reasonably be expected to reduce the likelihood of survival and recovery of these species, because once the development has occurred, the opportunity of utilizing the land to contribute to survival and recovery is foreclosed. However, reduction in the likelihood of survival and recovery of these species should not be the case based on the assumptions that: any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect; implementation of and conformance with recovery plans will be an integral part of site-specific consultation; Interior will work closely with the water users, providing them maps of listed species habitats within their service-areas and guiding them through the consultation process to address site-specific effects; conservation strategies will be in place for districts or areas receiving CVP water; the CVP will be managed in a manner consistent with the CVPIA Section 3406(b)(2) decision of October 1999; flow standards that form the environmental baseline of the 1995 OCAP biological opinion are met; Reclamation will not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed–Appendix K, letter to the Service and NMFS from Reclamation, dated October 29, 1999; Reclamation and CVP contractors comply with all opinions related to the CVP (listed on pages 1-4 and 1-5); Interior will ensure full implementation of the conservation actions described in the Project Description of this opinion, including Agency Commitments for New and Continuing Project Actions (page 2-3), specific guidance for Water Service Contracts (page 2-10) and Conservation Measures (2-31); discharges into surface water bodies by CVP contractors resulting from CVP water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (number 1-1-98-F-21); Reclamation will consult on all changes in purpose of use for CVP water contracts from Agriculture to Agriculture/Municipal and Industrial; monitoring is implemented which shows that the baselines of the species in Appendix B are stable or increasing;and the Bureau and the Service will coordinate when the quantity of water to be delivered to the districts exceeds the average historical delivery amounts and in the view of the Service may affect listed or proposed species.

Operations and Maintenance

Operations and maintenance activities include mowing, levee maintenance, dredging, pest control, erosion control, and flood control. Operations and maintenance activities can contribute to loss and degradation of most of the habitats listed in the Baseline section, but have the most impact on Delta aquatic habitats, vernal pools, wetlands, riparian habitats, grasslands, and alkali scrub.

The direct and indirect effects of operations and maintenance of the CVP include the following:

1. Canal maintenance or dredging disturbs wetland habitat, increases siltation, and disturbs behavior of aquatic listed species.

2. Direct mortality from vehicle traffic, mowing, and burning on levees and near canals.

3. Flood control (including flow restrictions, levee maintenance and installation of riprap) can interfere with the natural regeneration processes of forests and alter other upland and wetland habitats by removing vegetation or changing patterns of disturbance and sediment deposition.

4. Continued disturbance of habitats around facilities through maintenance activities prevents reestablishment of native habitat and disturbs hibernating or denning species.

5. Insecticides, herbicides, and rodenticides applied around facilities can adversely affect listed species by: direct mortality; secondary poisoning of predators and scavengers; degradation of habitats following herbicide application; loss of prey base after pesticide application; reduced water quality; pesticide and herbicide drift; and loss of pollinators.

Degradation of listed species habitats and mortality and disturbance of listed species is expected to continue as a result of continued operations and maintenance activities associated with CVP facilities.

Operations and maintenance can reasonably be expected to reduce the likelihood of survival and recovery of these species. However, this should not be the case given the assumptions that: O&M plans are developed and implemented by all Reclamation area offices as described in this opinion and are consistent with section 7(a)(1) of the ESA; Interior will ensure full implementation of other conservation actions described in the Project Description of this opinion, including Agency Commitments for New and Continuing Project Actions (page 2-3), specific guidance for Water Service Contracts (page 2-10) and Conservation Measures (2-31); any site-specific effects to listed species will be addressed through site-specific analysis and implementation of avoidance measures in compliance with this opinion; implementation of and conformance with recovery plans will be an integral part of management actions; Reclamation will consult on development and implementation of Resource Management Plans; Reclamation and CVP contractors comply with all opinions related to the CVP (listed on pages 1-4 and 1-5); discharges into surface water bodies resulting from CVP water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (Service File # 1-1-98-F-21); monitoring is implemented which shows that the baselines of the species in Appendix B are stable or increasing.

Duration

The effects of the CVP can be divided into three types, based on duration of effect.

1. Short-term events whose effects are relaxed almost immediately. Routine maintenance activities tend to be short-term events.

2. Sustained, long-term events whose effects are not relaxed. Water flows vary from year to year depending on available flows and contract deliveries. The continued impoundment, pumping, and diversion of water has long-term effects on species dependent on historical water flows.

3. Permanent events that set a new threshold for some feature of a species' environment. The construction of dams and the corresponding loss of a riparian corridor and the surrounding land due to flooding is an example of a permanent event. Conversion of land for intensive agricultural uses or urban centers also permanently removes that habitat for use by listed species dependent on that habitat.

The CVP was initiated to provide a steady water supply to water users. As such, the effects of the CVP tend to be sustained events or permanent changes.

Disturbance Frequency, Intensity, and Severity

Water is diverted every year to fulfill various water rights and water contracts. Most agricultural fields are irrigated every year, although the intensity of irrigation may vary from year to year depending on available water. Some fields are fallowed each year. In the event of a prolonged low-flow period, the effect of continued diversions on listed species would be greater. Pesticides are applied every year, often more than once a year, on most fields.

Conversions of habitat facilitated by CVP water have drastically reduced the range of many listed species. Listed species may or may not be able to recover from repeated disturbance, depending on the sensitivity of the species, the severity of the disturbance, and the other stressors in its environment. Listed species tend to be more sensitive to disturbance and habitat loss, simply due to their restricted range. Each species will react differently to the disturbance. Refer to the individual species accounts in Appendix 6 for explanation of the reasons for decline and sensitivity to disturbance.

Even relatively small land conversions facilitated by the CVP in rare habitats such as gabbro soils, serpentine soils, dunes, and vernal pools can significantly reduce the range of already rare species. This can be especially true of listed plant species that are dependent on specific soil types for survival, as well as the animal species that utilize those plants.

The disturbances and habitat loss caused by the CVP leave species more vulnerable to other stressors in their environment, such as floods, drought, fires, disease, pollution, and predators. Species with severely restricted ranges become vulnerable to inbreeding, hybridization with other subspecies, and genetic drift. Severe or moderate disturbances can decrease the recovery rate of a species or reduce the chances of recovery. Direct and indirect effects of the CVP have caused many native species in the Central Valley to be listed, and continued activities may continue to negatively impact listed species. Many direct, indirect, interrelated, and interdependent effects of the CVP have occurred and are expected to continue to occur.

Conservation Measures

Reclamation and the Service have committed to implementation of conservation measures associated with various biological opinions and passage of the CVPIA. Activities include implementation of: biological opinions and their associated programs, actions associated with CVPIA, measures to reduce or eliminate adverse effects to plant and animal species associated with operation and maintenance of CVP facilities, actions under the wetlands program, and the Central Valley Project Conservation Program. Full implementation of these programs and consultation to minimize any secondary adverse effects is crucial to maintaining or increasing the likelihood of survival and recovery of listed species in the affected area. More detail on these programs is provided in the Project Description section of this document.

CVPIA Programs

One of the purposes of the CVPIA is to protect, restore, and enhance fish and wildlife populations and their habitats. Most of the provisions of the CVPIA deal with methods to improve the habitat and survival of native fish. Through programs such as the Anadromous Fish Restoration Program, the impacts of the CVP on listed fish species is expected to be reduced. Full implementation of the CVPIA would result in increased flows in the Sacramento and San Joaquin Rivers and their tributaries, and increased Delta outflow through acquisition of (b)(2) and (b)(3) water. These flows would have a positive impact on Delta fishes, anadromous salmonids, and other listed species. Increased Trinity River flows would improve habitat for listed species in the Trinity River system. Fish screens, fish passages, reduced flow fluctuations, and other modifications to operations would result in increased survival, increased reproductive output, improved habitat quality, and decrease the possibility of entrainment of Delta fishes and anadromous salmonids. Modifications of dams, pumping plants, and fish hatcheries would also improve habitat quality for Delta fishes and anadromous salmonids.

Full implementation of the CVPIA will improve water supplies for anadromous fish and improve refuge water supplies. Land fallowing would decrease the use of pesticides in the local area, potentially affecting water quality. Land fallowing, flooding of fields, and full level 4 refuge water supplies are expected to benefit both terrestrial and aquatic listed species.

Increased flows and riparian restoration programs would increase riparian areas used by listed species. Riparian restoration efforts would increase riparian areas along Clear, Cow, Cottonwood, Mill, Deer, and Big Chico Creeks, and the Sacramento, Yuba, lower American, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers. Increased flows would increase riparian areas on other rivers as well. The (b)(1)"other" program would benefit listed species through habitat acquisition, management, restoration, and studies. Improvements in fisheries resources would improve conditions for piscivorous wildlife.

The CVPIA land retirement program may benefit species eventually, depending on the quality of land that is retired and restoration efforts. Retirement of severely degraded land is unlikely to benefit listed species. Water that is released back to the district from retired land will allow further land conversion. Long term effects which could include eventual habitat rehabilitation may take 10-20 years. Further documentation is needed to determine the effect of land retirement on listed species.

Take Avoidance Plans

Implementation of the take avoidance measures described in the Operations and Maintenance Manual is necessary to maintain or increase the likelihood of survival and recovery for listed species. The take avoidance measures would reduce take of endangered species and reduce the impact of maintenance of levees, mowing, and other activities. The Operations and Maintenance Manual contains measures to reduce impacts from earth moving, minor construction, erosion control, pest control, weed abatement, etc. on wetlands and sensitive, threatened, and endangered species.

Conservation Program and Other Resource Conservation Programs

Effects of the Conservation Program activities will, with time, provide a benefit by supporting recovery actions, through support of specific research activities to provide for better adaptive management of species and habitat, and to set aside lands and restore and enhance lands to provide habitat for species that have historically occurred within the CVP service area. Implementation of other resource conservation programs and restoration of wetlands should further improve existing conditions.

Implementation of the Conservation Program and other resource conservation programs will reduce the impacts of the many CVP activities on listed species. The Conservation Program and (b)(1) "other" program will create a means of preserving listed species habitat that is left. From 1993-1998, (b)(1) "other" and other CVPIA programs, in conjunction with state and private cooperators, contributed funds toward acquisition of 79,111 acres of upland habitat and 1,578 acres of riparian habitat, and these beneficial effects are expected to continue. Maintaining the likelihood of survival and recovery for listed species assumes full and timely implementation of high priority actions and Priority 1 recovery tasks for listed species, with corresponding increases in funding for (b)(1)"other and the Conservation Program. Take minimization measures, such as take avoidance plans, will reduce the likelihood of take from operations and maintenance of the CVP. With implementation of the ESA compliance strategy, the effects of many future actions on listed species would be reduced. Overall, the take avoidance measures, resource conservation measures, and full implementation of the CVPIA would minimize many of the impacts of the CVP.

As part of implementation of the Friant and Interim biological opinions, Reclamation in conjunction with the water districts has also accomplished a number of other conservation actions including: support of the Endangered Species Recovery Program; public outreach on endangered species issues; aerial photo analysis in the San Joaquin Valley; habitat enhancement projects (Kings River, Madera Equalizing Reservoir, etc.); a feasibility study for vernal pool creation; determination of land ownership

in areas of biological interest; and ground surveys for endangered species on private property and canal rights-of-way. These actions are likely to aid the recovery of listed species.

Cumulative Effects

Cumulative effects are those effects of future State, local, or private actions on endangered and threatened species or critical habitat that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action (*e.g.*, non-CVP Reclamation projects such as the Solano Project, Corps projects, and Forest Service or Bureau of Land Management actions) are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Numerous activities continue to eliminate habitat for listed and proposed threatened and endangered species in the Central Valley. Habitat loss and degradation affecting both animals and plants continues as a result of urbanization, oil and gas development, road and utility right-of-way management, flood control projects, overgrazing by livestock, and continuing agricultural expansion. Listed and proposed animal species are also affected by poisoning, shooting, increased predation associated with human development, and reduction of food sources. All of these nonfederal activities are expected to continue to adversely affect listed and proposed species in the Central Valley.

Cumulative effects on many species are severe enough to substantially reduce the likelihood of long-term survival and recovery of these species. Ongoing operation of the CVP contributes to the threat to these species. However, Reclamation's proposed ESA compliance strategy is designed to minimize further losses within the CVP service areas and to offset impacts from ongoing CVP operations. Thus Reclamation's proposed action and ongoing CVP operations would not contribute to, but instead would serve to lessen, the adverse impacts of nonfederal activities that otherwise could jeopardize the survival of listed threatened and endangered and proposed species within the Central Valley. Part of Reclamation's commitment is to adopt an adaptive strategy in the implementation of recovery and enhancement actions. As more information becomes available, components of actions can be modified to provide the most benefit. This strategy should hasten the recovery of species within the Central Valley over time.

In this section, a general description of the adverse impacts to habitats described in the Baseline section of this opinion are characterized. The habitat sections that follow describe in more detail how activities and events are impacting listed species.

Cumulative Effects to Habitats

Delta Aquatic Habitats

Delta fishes continue to be adversely affected by entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, destruction of spawning and refugial areas, change in the hydrologic

patterns in Delta waterways, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle *et al*. 1992). Reduced or reversed flows due to pumping can confuse migrating fishes and lengthen out-migration periods. Pumping activities can concentrate Delta fishes and their predators in small areas where predation risk is increased. Fish can be killed by impingement on screening facilities at high flow rates, entrainment through pumping plants, and diversion into unsuitable habitat. Reduction in food supply due to water diversions can also cause increased mortality. Water diversions contributing to these cumulative effects include intakes serving non-federal pumping plants, municipal and industrial uses, water for power plants, and numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay. Suitable water quality must be provided by addressing point sources of contaminants so that maturation is not impaired by pollutant concentrations. Levee maintenance disturbs spawning and rearing habitat, and re-suspends contaminants into these waters.

Cumulative effects on the delta smelt and Sacramento splittail include any continuing or future non-Federal diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting the position of these fish species preferred habitat upstream. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses, as well as providing water for power plants. Delta smelt adults seek shallow, tidally influenced, fresh water (*i.e.*, less than 2 ppt salinity) backwater sloughs and edgewaters for spawning. To assure egg hatching and larval viability, spawning areas also must provide suitable water quality (*i.e*., low concentrations of contaminants) and substrates for egg attachment (*e.g*., submerged tree roots, branches, emergent vegetation). Suitable water quality must be provided by addressing point sources of contaminants so that maturation is not impaired by pollutant concentrations. Levee maintenance disturbs spawning and rearing habitat, and resuspends contaminants into these waters.

The introduction of exotic species may occur when the levees are breached or when separate creeks or river systems are reconnected during various projects. Several exotic species may adversely affect the delta smelt and splittail, including the Asian clam and three non-native species of euryhaline copepods. The Asian clam could potentially play an important role in affecting the phytoplankton dynamics. The exotic copepods may displace native species and at least one species of copepod (*Sinocalanus doerri*) is difficult for larval fishes to catch because of its fast swimming and effective escape response. Reduced feeding efficiency and ingestion rates weaken and slow the growth of young and make them more vulnerable to starvation and predation.

Other cumulative effects include: wave action in the water channel caused by boats that can degrade riparian and wetland habitat and erode banks; the dumping of domestic and industrial garbage, presenting hazards to the fish because they could become trapped in the debris, injure themselves, or ingest the debris; reduction of habitat, and introduction of pesticides and herbicides, from golf courses; oil and gas development and production remove habitat and may introduce pollutants into the Napa River; agricultural uses on levees reduce riparian and wetland habitats; residential or agricultural land

use can fragment and reduce wildlife habitat and corridors; unscreened agricultural diversions throughout the delta divert all life stages of the fish (Service 1996); and grazing activities may degrade or reduce suitable habitat.

Additional cumulative effects result from the impacts of point and non-point source chemical contaminant discharges. These contaminants include selenium and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt and Sacramento splittail, these contaminants may adversely affect delta smelt and Sacramento splittail reproductive success and survival rates. Spawning habitat may also be affected if submersed aquatic plants used as substrates for adhesive egg attachment are lost due to toxic substances.

Vernal Pools

Activities that contribute to vernal pool habitat losses include plowing and deep-ripping for agriculture, energy development, urban development, flood control projects, highway and utility projects, and overgrazing (California Department of Fish and Game 1992; 58 **FR** 41700; 59 **FR** 48136). Limited distributional patterns increase the susceptibility of individual populations and entire species to severe declines from both natural and human-induced disturbances. Much of the remaining vernal pool habitat continues to be degraded by fragmentation, changes in hydrologic patterns, off-road vehicle use, increased competition from non-native species, periodic drought, and miscellaneous human disturbances. In many areas, the cumulative effects of habitat loss, fragmentation, and degradation reduce the potential for remaining habitats to indefinitely sustain viable populations of rare species. Some vernal pool complexes are protected from disturbance, but the majority remains under pressure for development, and threatened by activities such as agricultural and urban development, mosquito abatement, gravel mining, flood control and water conveyance projects, pipeline projects, reservoir construction, off-road vehicle use, intensive livestock grazing, refuse disposal, and other activities (59 **FR** 48136). Listed plant species endemic to vernal pool habitats are adapted to hydroperiods with winter inundation and summer drying, and are outcompeted by marsh plants when hydrology is altered so standing water is permanently present.

Freshwater Wetland Habitats

These wetlands continue to be drained for agricultural and urban use. Some wetlands may also be inundated by reservoirs and converted to open water habitat. Conversion of natural habitats to agricultural and urban uses results in loss of marshes, sloughs, ponds, and small streams. Many of the remaining wetlands may be converted from seasonal to permanent water inundation. Habitat value of some man-made wetlands (rice fields, canals, reservoirs) is adversely affected by maintenance activities and pesticide use.

Riparian Habitats

Factors contributing to the loss of riparian forest include: (1) continued conversion of nonirrigated land to irrigated agriculture, (2) levee construction and maintenance, (3) bank erosion, (4) browsing by livestock, (5) use of riprap for bank protection, (6) groundwater extraction, (7) flow regulation, and (8) the continuing development of land along the riparian corridor. Dams flood riparian vegetation in their impoundments and degrade it downstream by altering flows and geomorphic processes. Flood control interferes with natural processes that affect forest regeneration. Controlled water release from dams reduces mid-successional habitat (dominated by brush and young to mid-aged trees). Unusually heavy or extended flooding of remnant riparian habitats can be detrimental to some terrestrial endangered species (*e.g.*, riparian brush rabbits could drown or be isolated in small upland refugia where they would be more vulnerable to predation; giant garter snakes dormant in burrows could drown or be forced to seek new hibernacula).

Coastal Beach, Lagoon, and Inland Dune Habitats

Continued recreational use of beaches causes disturbance to nesting snowy plovers and least terns from pets, beachcombers, and off-road vehicles. Dune habitats on coastal beaches continue to be altered by the introduction of invasive dune-stabilizing vegetation (especially the beach grass *Ammophila arenaria* and the ice-plant *Carpobrotus edulis*). Dune-stabilizing vegetation competes for space with native dune plants (see Table 3.D) and stabilizes open sand faces needed by native dune plants.

Lagoon habitats are altered by upstream water diversions, dredging, and associated changes in salinity, pollution, and siltation. During drought periods, the lack of rainfall, combined with human induced water reductions (*i.e.*, diversions of water from streams, excessive groundwater withdrawals), degrades lagoon ecosystems and creates extremely stressful conditions for most aquatic species. The introduced yellowfin goby (*Acanthogobius flavimanus*) may also compete with the tidewater goby in lagoon habitats.

Ongoing threats to listed species at the Antioch Dunes include competition from weedy species, disturbance from fuel break maintenance and people walking to the riverfront, and ecological changes resulting from severe reduction, fragmentation, and degradation of the dune ecosystem (U.S. Fish and Wildlife Service 1984).

Salt Marsh Habitats

Pollution, over-exploitation of commercial fisheries, water diversions, and introduction of numerous non-native species continue to affect the ecology of San Francisco Bay tidal marshes. A number of factors influencing the remaining tidal marshes limit their habitat value. Much of the East Bay shoreline from San Leandro to Calaveras Point is rapidly eroding. Many marshes around South San Francisco Bay are undergoing vegetational changes because of land subsidence caused by groundwater pumping. In addition, an estimated 600 acres of former salt marsh along Coyote Creek, Alviso Slough, and Guadalupe Slough is currently dominated by fresh- and brackish-water vegetation due to continuing freshwater discharge from South Bay wastewater facilities and is thus of lower quality for California

clapper rails and salt marsh harvest mice. In San Pablo and Suisun Bays the average salinities are increased by upstream diversions by the CVP and DWR water projects. Intertidal and riparian marsh habitats used by species such as the California clapper rail, salt marsh harvest mouse, and Suisun thistle may be degraded or destroyed by a variety of development and maintenance activities conducted by private organizations or state or local governments.

Interior Grassland Habitats

Grassland losses have continued to result from urban expansion and conversion to irrigated croplands. Degradation of grassland quality also continues, especially on heavily grazed rangelands. Conversely, grasslands are also being created by conversion of other native habitats for grazing.

Alkali Scrub Habitats

Alkali scrub habitat continues to decline because of agricultural conversion, flood control, and groundwater pumping.

Oak Woodland Habitats

Continued habitat loss and decline results from clearing for livestock forage improvement, residential and commercial development, fuelwood harvesting, agricultural conversion, and other activities. In many areas, remaining oak woodlands are declining due to lack of regeneration and survival of young trees. The reasons for the lack of stand regeneration in oaks are not well understood; however, competition with introduced grasses; fire suppression; and consumption of acorns and seedlings by livestock, rodents, and other wildlife have all been implicated (Mayer *et al*. 1986, Griffin 1977). Urban and agricultural development, rangeland improvement, fuel harvesting, and other activities continue to eliminate oak woodland habitats.

Coniferous and Mixed Forest Habitats

Continuing timber harvest creates large areas of early-successional clearcuts and even-aged young stands, reduces the structural complexity of forests, diminishes the availability of snags and deadwood habitat, increases the fragmentation of habitat with logging roads and clearcuts, and causes soil erosion into streams. Local areas of forest are severely affected by mining and the growth of urban areas.

Chaparral Habitats

Chaparral habitat continues to be converted to urban areas and agricultural land. In many areas deterioration of remaining habitat results from fire suppression, which leads to excess accumulations of woody material and unusually large and intense conflagrations when fires eventually occur (Hanes 1977).

The species associated with gabbro soils are declining as a result of: habitat loss, fragmentation, and alteration of natural ecosystem processes caused by residential and commercial development; grading, road construction and maintenance; fire suppression; herbicide use; unauthorized dumping; mining; and other activities (59 **FR** 18774).

Fifteen active surface mines on private land near Ione continue to remove Ione soils habitat; approved reclamation plans show that in excess of 3,500 acres of surface removal will occur. Plants on Ione soils are also threatened by disease, clearing of vegetation for irrigated/cultivated agriculture and fire protection, habitat fragmentation, residential and commercial development, changes in fire frequency, and ongoing erosion.

Sierra serpentine habitats are being reduced and degraded by urbanization. Species on serpentine soils are also adversely affected by firebreak construction, agricultural land conversion, livestock grazing, trash dumping, off-road vehicle use, recreational gold mining, and trampling by hikers.

Coastal Scrub and Coastal Grassland Habitats

Four major factors contribute to changes in the distribution and composition of coastal prairies: the introduction of highly competitive, non-native species; an increase in grazing pressures; the elimination of annual fires; and cultivation (Heady *et al*. 1988). In addition, urban growth is increasingly causing fragmentation and restriction of coastal prairie and coastal scrub habitat. Threats to species on these habitats include loss of habitat to urbanization, roadkill fatalities, illegal collection, off-road vehicle use, unsuitable levels of livestock grazing, trampling of food plants by horses and hikers, use of insecticides, rock and sand quarrying, and invasive exotic vegetation.

Ongoing threats to listed and proposed species on serpentine habitats in the Bay Area include urban growth (including residential developments, golf courses, road and highway construction, and waste disposal), recreational use of open space (resulting in erosion and facilitating growth of weedy species), invasion by non-native plants, and ecological changes resulting from severe habitat reduction and fragmentation (57 **FR** 59053).

Threats to endemic species of Zayante sandhill habitats include destruction of habitat from residential development, recreational activities, equestrian use, agriculture, invasion by non-native vegetation, changes in fire cycles, and sand mining.

<u>Instream Flows and Water Impoundments and Diversions</u>

Hydrodynamic conditions in the Delta are tied to continuing and future hydraulic modifications in the Delta made for various beneficial purposes, such as levee construction for land reclamation and flood control; channel dredging, enlargement, and deepening for navigation and levee maintenance; operation of diversion pumps, siphons, and drainage pumps; and construction of non-Federal export pumping plants and associated facilities for water management. Increased demands may further reduce reservoir

storage and will adversely affect riverine conditions. Reduced availability will result from: (1) operations that reduce the frequency of spill from upstream reservoirs; (2) build out by senior water right holders; and (3) changes in the criteria that define surplus flows. Continued upstream impoundment and diversion of snowmelt will reduce the potential for high spring outflows. Because surplus flows combined with required flows in the Water Quality Control Plan are critical for transporting fish larvae to rearing habitat and maintaining that rearing habitat in a suitable location in Suisun Bay, new diversions of surplus water will reduce the likelihood that fisheries declines will be reversed. Variation in climate between years can also exacerbate the cumulative effects of water diversions. Annual rainfall has varied greatly over the last 10 years. Drought conditions increase demand for water while reducing the total amount of water available for fish and wildlife, agricultural, municipal and industrial uses, and can thus result in additional shortfalls in instream flow and upstream movement of the 2 parts-per-thousand (ppt) isohaline (X2). Extremely high precipitation events can also adversely affect endangered species. Delta fishes can suffer increased mortality if they are carried out of their preferred estuarine habitats toward San Francisco Bay by high outflows.

Contaminants and Water Quality

Agricultural and industrial activity can introduce contaminants into water used by threatened and endangered species. These contaminants may include selenium, arsenic, cadmium, chromium, copper, mercury, lead, nickel, silver, tributyltin, zinc, hydrocarbons, and organochlorines. Contaminants may enter surface waters through point source spills and discharges, urban and agricultural runoff, deposition of atmospheric aerosols, and dredging that releases contaminants trapped in sediments.

The major source of water contamination in the Central Valley is agricultural drainwater, which has high salinity, high selenium concentrations (particularly in water draining selenium-rich soils in the San Joaquin Valley), and pesticides. Dumping of highly saline drainwater into rivers can have similar adverse effects on aquatic organisms.

Evaporation ponds which concentrate selenium-rich drainwater can attract wetland animals which may then die or suffer developmental abnormalities from selenium toxicity. Broadcast spray of malathion and other pesticides in agricultural areas can drift into non-target areas, kill plant pollinators, reduce insect prey species, and contaminate runoff. Pesticides cause death of the small invertebrates and zooplankton that support the food chain, and can be toxic to higher-level predators by bioaccumulating to increased concentrations. Eggs and larvae of aquatic organisms are particularly vulnerable to mortality or developmental abnormalities from pesticides. Levee maintenance and dredging resuspends contaminants trapped in sediments. Selenium, pesticides, and herbicides may adversely affect delta smelt and Sacramento splittail reproductive success and survival rates.

Spillage of wastewater from mining activity (particularly the Iron Mountain Mine) could potentially introduce large pulses of water laden with contaminants such as copper, zinc, and cadmium into Central Valley river systems and the Delta. Central Valley waters could also be contaminated by incidental leakage of gasoline and oil from vehicles and storage tanks, illegal dumping of waste oil, or accidental

spills of chemicals or fuel oil from tank trucks or rail cars. Release of contaminated ballast in San Francisco Bay further reduces water quality.

Exotic Species

Exotic species continue to spread and be introduced into aquatic habitats of the Delta and Central Valley rivers. Releases of ballast water from ships or deliberate stocking of fish introduce exotic species into water bodies. Exotic euryhaline clams reduce the abundance of phytoplankton. (Euryhaline species are able to live in water with widely varying salinity.) Exotic diatoms growing in chains are more difficult for zooplankton to graze upon. Introduced copepods are more difficult to catch than native copepod species and may thus reduce food availability for native fishes. Introduced silversides and gobies may prey on eggs and larvae of native fishes. Larval striped bass and other exotic fish may compete for food and space with native fishes. Delta smelt may hybridize with the introduced Japanese pond smelt. Introduction of large predatory fish such as northern pike has the potential to greatly increase mortality of native fishes.

Introduced bullfrogs pose a great threat to a variety of aquatic species, including snakes, fish, and other frog species. Adult bullfrogs are accomplished predators which can populate an area quickly and outcompete, as well as prey upon, the natives.

Introduced plants have also caused problems for native species. Exotic plants compete with native plants for light, space, and nutrients. The lack of natural population controls for exotics (*i.e.*, predators, disease, etc.) can allow these species to completely outcompete native species and form a monoculture of an introduced species. Species such as the Brazilian elodea (*Egeria densa*) and yellow star thistle (*Centaurea solstitialis*) have taken over aquatic and terrestrial habitats (respectively) in California.

Native Habitat Conversion and Associated Activities

Terrestrial and wetland habitats used by threatened and endangered species continue to be modified or converted by private entities or state or local governments. The increase in urbanization and agricultural conversion increases fragmentation and degradation of remaining habitat.

Land conversions that occur include: oil and gas development; mining or quarrying for sand, gravel, or minerals; liquid waste treatment plants; wind farms; pipeline installation; transmission line installation; creation of reservoirs or evaporation ponds; construction of roads or other transportation infrastructure; urban or industrial developments; or agricultural conversion. Land conversions can result in take of a wide variety of threatened or endangered animal species, including but not limited to giant garter snake, California red-legged frog, San Joaquin kit fox, blunt-nosed leopard lizard, valley elderberry longhorn beetle, and vernal pool crustaceans. Numerous threatened and endangered plants of vernal pool, wetland, grassland, serpentine, and alkali scrub habitats are also affected by ongoing habitat conversion. Areas of endemism where habitat conversion would have disproportionately large effect on listed species include: remnant vernal pool complexes and riparian habitats in the Sacramento and

San Joaquin Valleys; alkali scrub/grassland habitats of the San Joaquin Valley and Carrizo Plain; the San Bruno Mountain and Milagra Ridge area of San Mateo County; the gabbro and serpentine soils of the Pine Hill intrusion in El Dorado County; the Antioch Dunes in Contra Costa County; the Zayante sand hills of the Santa Cruz Mountains; and the serpentine soils of the San Francisco Bay and Santa Clara Valley areas. Many of these areas are currently under great pressure to be developed for municipal and industrial uses.

Conversion of land for agricultural purposes continues to be the most critical threat to listed species. Although the increment of habitat loss attributable to urban development appears to be increasing, these activities remain less significant, for most species, than conversion of native habitats for irrigated/cultivated agriculture. Agricultural conversion is generally not subject to any environmental review and is not directly monitored or regulated. Conversion of privately owned habitat without use of federally supplied water or filling of wetlands typically does not result in section 7 consultation with the Service, nor is it usual for there to be an application for a section 10 incidental take permit. Illegal fill of wetlands without Corps permits has occurred in the past and is likely to continue. In addition, CVP water is used for groundwater recharge by some districts in the San Joaquin Valley. Such recharge may allow nearby landowners to pump groundwater for uses that may affect listed and proposed species.

The California Department of Forestry (1988) has predicted wildland habitat losses totaling 110,000 acres in the Sacramento Valley region and 465,000 acres in the San Joaquin Valley region between 1980 and 2010 as a result of agricultural conversion and urbanization. Much of the projected loss is likely to occur in the remaining blocks of habitat for listed and proposed species.

During habitat conversion threatened and endangered species could be killed or injured by operation of heavy equipment (crushing, burial by earthmoving equipment, discing, grading, mowing) or flooding of habitat. Individuals could be harassed during construction by noise, ground vibrations and compaction of burrows, construction lighting, and disruption of foraging and breeding behavior. Individuals not killed directly by operation of equipment would probably find themselves in suboptimal habitat with a decreased carrying capacity due to lower availability of foraging and breeding habitat and greater vulnerability to predation. If individuals were displaced from converted lands into nearby native habitat, population densities would rise and intraspecific competition and predation pressure would be likely to increase. Animals that loose their fear of humans can become more vulnerable to shooting, poisoning, and roadkill. Habitat conversion also reduces the availability of suitable habitat for future recovery of species and isolates populations by increasing habitat fragmentation.

Some listed terrestrial species (*e.g.*, bald eagle, San Joaquin kit fox, kangaroo rats, giant garter snake) are vulnerable to accidental or intentional unauthorized take by electrocution on electric fences or power lines, trapping, shooting, clubbing, or poisoning. Incidental disturbance from human activity may also cause disruption of normal foraging and reproductive activities. Listed plants may be threatened by vandalism or horticultural collecting. Listed butterflies can be threatened by unauthorized collecting by

lepidopterists. These forms of unauthorized take are likely to occur more frequently as the human population in the Central Valley increases and native habitat is fragmented and converted.

Vehicular traffic is an ongoing hazard that can cause roadkill mortality for a wide variety of terrestrial listed species (*e.g.*, giant garter snake, blunt-nosed leopard lizard, San Joaquin kit fox, California red-legged frog). Traffic will be increased by construction of new roads and agricultural, industrial, and urban development. As barriers to dispersal, roads also reduce the probability that unoccupied habitat will be colonized by listed species. Roadside maintenance can affect listed plants by grading, mowing, erosion control, and spraying of herbicides.

Off-road vehicles can kill or injure listed plants and animals, as well as causing erosion, harassing animals with noise and ground vibrations, and crushing burrows used for shelter. Heavy pedestrian foot traffic can also compact soil and trample plants and small or dormant animals.

Rodent control measures can: reduce the availability of prey for listed predators (*e.g.*, San Joaquin kit fox); injure or kill listed predators through secondary poisoning if poisoned rodents are eaten; injure or kill other listed species (*e.g.*, Fresno, Tipton, and giant kangaroo rats, San Joaquin woodrat) that may eat rodenticide-treated baits; and reduce the availability of ground squirrel burrows as shelter and hibernation refugia for listed species (*e.g.*, giant garter snake, San Francisco garter snake, kangaroo rats). Use of burrow fumigants on levees and other potential upland refugia can injure or kill listed species sheltering in ground squirrel burrows.

Urban and agricultural development results in increased abundance of domestic and feral cats and dogs, as well as wild predators (such as raccoons, red foxes, and skunks) that are attracted to trash dumping and suburban developments. This high abundance of predators can result in increased predation rates for small terrestrial vertebrates, including listed species (*e.g.*, blunt-nosed leopard lizard, giant garter snake, California red-legged frog). Listed predatory species such as the San Joaquin kit fox may similarly suffer increased competition for space and food. Other indirect effects from urbanization include increased disturbance levels, ground slumping, garbage dumping, altered fire regimes, vandalism to protected habitats, increased foot traffic through protected areas, and unauthorized activities that adversely affect the survival of rare species.

Listed plant species can be buried or killed by dumping of trash, fill dirt, or garden debris. Dredging and clearing of vegetation from irrigation canals reduces foraging habitat and escape cover for giant garter snakes. Listed species in wetland habitats (including vernal pool crustaceans and eggs and tadpoles of California red-legged frogs) may be injured or killed by mosquito abatement measures including pesticide application and predation by introduced mosquitofish.

Hydrological changes caused by development can include changes in the water table or increased runoff from upslope agricultural irrigation, residential development, or golf courses. Erosion and slumping of soils may result from changes in hydrology. These effects may change the suitability of habitat for listed plant species.

Transformation of watercourses and wetlands from seasonal to permanent hydroperiods by irrigation and damming alters the plant and animal communities, allowing colonization by bass, sunfish, bullfrogs and emergent marsh vegetation such as cattails and tule reeds. Tadpoles of California red-legged frogs typically metamorphose by late summer and are able to survive if wetlands dry in early autumn. Bullfrogs, which are larger and have a longer tadpole period, will competitively exclude California red-legged frogs in permanent water bodies. Bullfrogs, bass, and sunfish will also prey on California red-legged frog eggs and tadpoles.

Oil exploration poses a threat to many species as well. Construction of pads and roads associated with oil development, as well as the process of finding oil deposits can disturb large areas of habitat. Noise, vibration, traffic, and other human disturbances can also adversely affect species in the area.

Grazing and Land Management

Livestock grazing on State and private lands can cause erosion and degradation of riparian vegetation that provides habitat for listed species such as the valley elderberry longhorn beetle, southwestern willow flycatcher, riparian brush rabbit, and San Joaquin woodrat. Livestock wallows may degrade seasonal wetlands that harbor listed species. Trampling can also collapse rodent burrows used as shelter by some listed species. Listed plant species can be adversely affected by overgrazing and trampling, which can reduce survival and reproductive output of plants. However, in some cases moderate levels of grazing may be beneficial to listed plants by preventing establishment of competing species. Management for high deer and elk populations can also result in increased grazing and browsing pressure on listed plant species.

Most native plant species have adapted to a certain level of grazing pressure. Grazing management practices are often incompatible with the continued survival of certain species. For many species, the grazing management that would best suit the species is simply unknown. This may lead to inappropriate habitat management practices.

Logging on State and private lands can kill or harm listed species that require mature forest habitat (*e.g.*, marbled murrelet, northern spotted owl). These species could be directly killed or injured by destruction of active nests, or indirectly harmed by increasing predation risk or reducing the availability of nest sites, suitable foraging habitat, or prey.

Fire management activities can change the fuel load and the frequency and severity of fires. The fire regime can affect listed plants by changing germination success, seed bank composition, adult mortality, and intensity of interspecific competition.

Management regimes that pose a threat to species include: lack of protection on private lands, lack of funding for protection, lack of funding for correct management, management practices for one species that eliminates another, or inappropriate habitat management due to lack of information on the biology

of the species. Private land management practices can also be incompatible with the continued viability of species.

Population Size and Life History

Certain aspects of the biology of species put them more at risk of extinction from habitat degradation and fragmentation. Small populations are more at risk to random catastrophic events than large populations. Events such as drought, flooding, predators or pests, fires, and disease can pose a serious threat to a species that is limited to only several small populations. Small populations are also at risk of genetic drift, hybridization with closely related species or subspecies, and inbreeding. The lack of genetic variability leaves species at further risk to random events. Many native species are dependent on rare habitat types, leaving them at risk from development in these areas. Species with low density, low reproductive rate, large home ranges, or dependency on social facilitation are further at risk to multiple stressors.

Conclusion

After reviewing the current status of the species in Appendix B, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, the Service has determined that the level of programmatically anticipated take is not likely to result in jeopardy to the species listed in Appendix B, or destruction or adverse modification of critical habitat. In the absence of the conservation measures and other commitments in the **Project Description**, the effects analysis above would support a conclusion of jeopardy for many of the listed species in the affected area; however, this no-jeopardy determination is based upon implementation of and compliance with all of the **Assumptions** used in this analysis (page 4-1).